

Nutritional Profiling of Different Tannia (*Xanthosoma sagittifolium*) Genotypes

Nilima Karmakar and Himani Patel

(Received : February 13, 2024; Revised : December 15, 2024; Accepted : January 15, 2025)

ABSTRACT

In the present study total of eleven genotypes of *Xanthosoma sagittifolium* were screened for different biochemical and chemical parameters. The name of eleven genotypes were NT-1, NT-M, NT-3, NT-4, Nt-5, NT-6, NT-7, NT-8, NT-9, NT-10 and Konkan harit parni. Maximum carbohydrate was found in the leaves of NT-8, chlorophyll in NT-6, phenol in NT-5, antioxidant activity in NT-3, protein and fiber in NT-6, Leaf lignin was highest in NT-9, cellulose in NT-2, anthocyanin NT-9, ash in NT-7, ascorbate in NT-5 and lowest oxalate in NT-5, tannin in NT-9, phytate in NT-7. Highest Fe content was found in NT-7, Mn in NT-3, Zn in NT-8 and Cu in NT-9 leaves. Highest starch content was found in NT-9, amylose content in NT-2, amylopectin in NT-3, protein in NT-4, fiber in NT-3, lignin in NT-9 and cellulose in NT-8. Lowest oxalate was found in NT-8, tannin in NT-3, phytate in NT-1 genotype tubers. Highest Fe and Mn in NT-8, Zn in NT-6 and Cu in NT-9 tubers.

Key words : *Xanthosoma sagittifolium*, Genotypes, Biochemical analysis of Tannia Leaf, Nutritional profiling

Introduction

Tannia (*Xanthosoma sagittifolium*) also called the arrow leaf elephant ear, arrow leaf elephant's ear or American taro, is a tropical flowering plant that produces an edible, starchy corm (<https://www.inaturalist.org/taxa/154794-Xanthosoma-sagittifolium>). Cultivars which have purple stems or leaves are also called blue taro, purple taro, purple stem tannia, and purple elephant's ear among others. This tropical species is believed to have originated from northern South America and spread to the Caribbean and Mesoamerica and subsequently introduced elsewhere into Africa, Asia and the Pacific

(https://aems.nau.in/Main/view_experiment/436). The species is adapted to the wet, humid and warm tropics. It requires moist but well-drained, fertile soil and prefers partial shade. The mean temperature for their optimum growth must exceed 20 °C. In its natural habitat, it grows commonly under the rainforest canopy or naturalised along shady stream banks, but does not grow under flooded or swampy conditions. Although of tropical origins, the plant can withstand short periods of low cold temperature. This tropical plant is an important food crop – its edible corms provide energy-rich carbohydrates. They

¹N M College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India; ²ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

are eaten in various ways: boiled, steamed, baked, grilled, fried, mashed, creamed, pureed, in soups. The corms are also dried, peeled and ground to flour or meal for pastry that can be stuffed with meat or other fillings or to prepare puddings. Corms can be preserved for up to 18 weeks or longer in dry conditions, but unplanted corms can sprout in just a few weeks in hot, humid settings (Langeland *et al.*, 2008; Manner, 2011).

The young leaves are valued as boiled and fried vegetable as snacks. Tania is also a crop of south Gujarat region in India, where the leaves are customarily consumed as snacks (https://aems.nau.in/Main/view_experiment/436). Tania is also a crop of south Gujarat region in India, where the leaves are customarily consumed as snacks. Plants include a variety of phytochemical compounds, including vitamins, terpenoids, phenolic acids, lignins, stilbenes, tannins, flavonoids, quinones, coumarins, alkaloids, amines, betalains, and other antioxidant-rich metabolites. According to research, several of these antioxidant molecules contain anti-inflammatory, anti-mutagenic, anti-atherosclerotic, anti-carcinogenic, antibacterial, and antiviral properties (Jayaprakash, 2017). In this present experiment 10 different genotypes along with a national check variety will be analysed for their nutritive value. Both the mature leaves and corms was subjected to analysis to study the nutritional and antinutritional quality of leaves and corms.

Materials and methods :

The leaf and tuber samples were collected fresh from the RHRS,

Horticulture. NAU, Navsari. The leaf and tuber samples were immediately cleaned with water, soaked by tissue paper and dried under shed followed by processing and analysis. Moisture content was done by the method of AOAC (1965), Carbohydrate was done by the method of Hedge and Hofreiter (1962). The protein, ash, fibre, and crude fat contents of the flour were determined according to AOAC official methods 925.09 (AOAC, 2000). Antioxidant activity was done by the method of Blois, (1958). Ascorbate was done by the method of titration (Sadasivam and Balasubraminan, 1987). Protein content was estimated by Lowry *et al.* (1951). Phytate content was done by Early and Turk (1944). Lignin content and cellulose are determined by Jiang *et al.* 2014.

Result and discussion

In case leaf moisture content no significant difference was found and Konkan haritparni contained maximum moisture content (62.85%). Moisture content is a quality component for preservation, convenience in packaging and shipment, and serves as an identity standard (Bradley 2003).

Amount of leaf carbohydrate content was highest in NT-8 (5.62%) with no significant change among genotypes. The genotype NT-6 contained highest amount of chlorophyll (6.78%) at par with all other genotypes. The genotype had highest amount of phenol (50.98%) at par with other genotypes. NT-3 had highest antioxidant activity with lowest IC₅₀ value (82.77%). The highest protein content was found to be 7.18% in NT-6 which is at par with NT-4. Highest fibre percentage was

found in NT-6 (2.12%) at par with all other genotypes. The leaves are also important source of proteins and vitamins, representing an excellent source of calcium, phosphorus, iron, vitamin C, thiamine, riboflavin and niacin (Onweme, 1978; Siqueira *et al.*, 2023). Previous study on *Santhosoma* revealed 6.37% protein, 5.19% dietary fiber, and 3.99% total sugar respectively (Pérez *et al.*, 2007). Earlier study on *Xanthosoma* revealed 47.35 mg GAE/g of dry weight phenol in the stem part of the plant (Ashalata *et al.*, 2021). Apart from leaf, in proximate analysis of *Tannia* flour, Oyefeso *et al.* 2023 observed the Moisture content (wet basis), carbohydrate, protein, ash, crude fibre and fat content of the flour samples were within the ranges 4.43-12.74, 77.34-84.71, 2.22-4.22, 2.47-4.69, 0.34-2.50 and 0.63-3.72%, respectively.

In case leaf lignin content in the leaves the highest lignin content was found in NT-9 (7.08 %). Amount of leaf cellulose content did not differ significantly among genotypes with highest in NT-2 (20.02%). Jackix *et al.* (2013) found 3.14g/100g lignin in *Xanthosoma* leaves. The genotype NT-9 contained highest amount of anthocyanin content (23.52%) at par with NT-1, NT-2, NT-7, NT-8, NT-10 and Konkan haritparni. The genotype NT-5 had lowest amount of leaf oxalate content (0.05%). NT-9 had lowest tannin content (16.24%) at par with NT-1, NT-5, NT-7, NT-10 and Konkan haritparni. The lowest phytate content was found to be 1.48%, at par with all other genotypes. Highest Ash percentage was found in NT-7 (1.98%). Highest vitamin C content was found in NT-5 (14.83 mg/100g).

In case leaf Fe content maximum Fe content was found in NT-7 (50.67 ppm) at par with NT-1, NT-2, NT-6, NT-8 and NT-10. Amount of leaf Mn content was highest in NT-3 (19.00 ppm) with no significant variation among genotypes. The genotype NT-8 contained highest amount of Zn (14.373 ppm) at par with NT-1, NT-3, NT-4, NT-6, NT-7. The genotype had highest amount of Cu (0.88 ppm) at par with other genotypes like NT-2, NT-4, NT-5 and Konkan Haritparni.

Highest starch content was found in NT-9 (78.33%) at par with NT-4, NT-6 and NT-7. Amount of amylase content was highest in NT-2 (24.63%). The genotype NT-3 contained highest amount of amylopectin (57.25%) at par with NT-9 and NT-7. The genotype had highest amount of protein (12.26%) at par with NT-4 and NT-7. NT-3 had highest fiber content (3.60%). The highest lignin content was found to be 22.12% in NT-9 which is at par with NT-4, NT-6 and NT-10. Highest cellulose percentage was found in NT-8 (38.91%) at par with NT-1, NT-6 and Konkan haritparni.

Highest oxalate content was found in NT-5 (0.58%) at par with NT-9. Amount of tannin content was lowest in NT-3 (87.04%) at par with NT-9. The genotype NT-5 contained lowest amount of NT-5 (125.50%) at par with NT-9 and NT-1. The genotype NT-7 had highest amount of ash (3.76%) at par with NT-8. NT-8 had highest Fe content (94.33 mg/100g) and Mn (35.10 mg/100g). The highest Zn content was found to be 35.20% in NT-6. Highest Cu was found to vary insignificantly among the varieties. Mineral concentration depends on botanical source and soil conditions.

Previous study established, 0.03 ppm Zn and 0.05 ppm Fe in Santhosoma (Pérez *et al.*, 2007). Susan John and Remya Raj observed 147.5 ppm Mn, 2.492% Mg 2.368 %K, 1.029%Ca, 0.333 % P and 2.40 %N, respectively in the leaves of Tannia.

Conclusion

In a nutshell, it can be concluded that, the highest starch content was reported in NT-9, protein in NT-4. The genotype NT-8 tubers had the lowest oxalate content, Nonsignificant variation in cellulose and phytate % was reflected for all the treatments. No such significant variation observed in single genotype for Lignin, Anthocyanin Oxaloacetate, Tannin, Ash and ascorbate content in leaves. Fe and Mn levels are highest in NT-8 tubers, followed by Zn in NT-6 and Cu in NT-9 tubers. Hence, in future these genotypes may explored for their significant nutritional value in the variety release programme.

References

- AOAC 2000. Methods 925.10, 65.17, 974.24, 992.16. (in) *Official Methods of Analysis*. 17th Edition, The Association of Official Analytical Chemists, Gaithersburg, MD, USA.
- AOAC, 1965. (in) *Official Methods of Analysis of the Association of Official Agricultural Chemists*. AOAC, Washington DC.
- Ashalata, N., Swarnalata, N. and Laitonjam, W. S. 2021. Phytochemical Constituents, Total Flavonoid and Phenolic Content of *Xanthosoma sagittifolium* Stem Extracts. *Journal of Academia and Industrial Research (JAIR)* **10**(1): 1-4.
- Blois, M.S. 1958. Antioxidant Determinations by the Use of a Stable Free Radical. *Nature* **181**: 1199-1200. <http://dx.doi.org/10.1038/1811199a0>
- Bradley, R.L. 2003. Moisture and total solids analysis. (In) *Food analysis* (Nielsen, S.S. ed.) 3rd ed. New York: Springer. p 119–40.
- Early, E.B. and DeTurk, E.E. 1944. Time and rate of synthesis of phytin in corn grain during the reproductive period. *Journal of the American Society of Agronomy* **36**: 803–814.
- Hedge, J.E. and Hofreiter, B.T. 1962. (in) *Methods in Carbohydrate Chemistry* (Whistler, R.L. and BeMiller, J.N. eds.) Academic Press, New York, Vol. **17** p. 420.
- https://aems.nau.in/Main/view_experiment/436
- <https://www.inaturalist.org/taxa/154794-Xanthosoma-sagittifolium>
- Jackix, E. de Almeida., Monteiro, E. B., Raposo, H. F., Vanzela, E. C. and Amaya-Farfán. J. 2013. Taioba (*Xanthosoma sagittifolium*) leaves: nutrient composition and physiological effects on healthy rats. *Journal of Food Science* **78**(12):H1929-34. doi: 10.1111/1750-3841.12301.
- Jayaprakash, A. 2017. Phytochemicals, antimicrobial and antioxidant properties of *Annona reticulata* Linn. *Journal of Academia and Industrial Research* **6**(6): 90-95.
- Jiang, W., Han, G., Via, B.K., Tu, M., Liu, W. and Fasina, O. 2014. Rapid assessment of coniferous biomass

- lignin-carbohydrates with near-infrared spectroscopy. *Wood Science Technology* **48**(1):109–122.
- Langeland, K.A., Cherry, H.M., McCormick, C.M. and Craddock, K.A. 2008. Identification and biology of non-native plants in Florida's natural areas, Gainesville, Florida, USA: University of Florida IFAS Extension.
- Lowry, O. H., Rosebrough, N.J., Farr, A. L. and Randall, R. J. 1951. Protein measurement with the Folin phenol reagent. *Journal of Biological Chemistry* **193**(1):265-75.
- Manner, H.I. 2011. Farm and forestry production and marketing profile for Tannia (*Xanthosoma spp.*). (in) Specialty crops for Pacific Island Agroforestry (by Elevitch, C. R. ed.). Holualoa, Hawaii, USA: Permanent Agriculture Resources (PAR), pp.1-16.
- Onwueme, I.C. 1978. (in) *The Tropical Tuber Crops—Yams, Cassava, Sweet Potato and Cocoyams*. John Wiley and Sons, Chichester, 3-97.
- Oyefeso, B. O., A. Akintola., Akintunde, M. M., Ayandokun O. C., Fadele, O. K. and Ogunlade C. A. 2023. Proximate Composition of Tannia (*Xanthosoma Sagittifolium*) Flour As Influenced by Pretreatment and Drying Temperature. *LAUTECH Journal of Engineering and Technology* **17** (2): 58-66
- Pérez, E. E., Gutiérrez, M. E., de Delahaye, E. P., Tovar, J. and Lares, M. 2007. Production and Characterization of *Xanthosoma sagittifolium* and *Colocasia esculenta* Flours. *Journal of Food Science* **72**(6): S367–S372. doi:10.1111/j.1750-3841.2007.00420.x
- Sadasivam, S. and Balasubraminan, T. 1987. (in) *Practical manual in Biochemistry*. Tamil Nadu Agricultural University Coimbatore p14.
- Siqueira, M. V. B. M., Nascimento, W. F. do, Pereira, D. A., Cruz, J. G., Vendrame, L. P. de Castro., Veasey, E. A. 2023. Chapter 2 - Origin, domestication, and evolution of underground starchy crops of South America. (in) *Starchy Crops Morphology, Extraction, Properties and Applications Vol 1: Underground Starchy Crops of South American Origin: Production, Processing, Utilization and Economic Perspectives*. Academic Press. Pp.17-42.
- Susan John, K. and Remya Raj. R.T. 2023. Integrated nutrient management in tannia (*Xanthosoma sagittifolium* L. Schott): yield, plant nutrient concentration, plant uptake and soil chemical properties in an ultisol, Kerala. *Journal of Root Crops* **49**(1): 11–18. Retrieved from <https://ojs338.isrc.in/index.php/jrc/article/view/646>

Table 1 : Moisture, carbohydrate, chlorophyll, Phenol, Antioxidant activity, Protein and Fibre content in the leaves of eleven Tannia genotypes leaves.

GENOTYPES	Moisture %	Carbohydrate %	Chlorophyll mg/g	Phenol %	Antioxidant activity (IC ₅₀)	Protein %	Fibre %
NT-1	60.39 a	5.19 ab	5.08 b	47.77 bc	87.31 ab	5.26 cd	1.71 a
NT-2	61.21 a	4.52 b	6.06 ab	47.08 c	85.32 b	5.96 bc	1.78 a
NT-3	60.94 a	5.21 ab	5.73 ab	49.37 abc	82.77 c	6.11 bc	1.61 a
NT-4	60.39 a	4.99 ab	5.57 ab	48.04 abc	85.82 b	6.73 ab	1.65 a
NT-5	60.62 a	4.92 ab	6.07 ab	50.98 a	88.19 a	4.92 d	1.69 a
NT-6	61.38 a	5.26 ab	6.78 a	49.87 abc	86.92 ab	7.18 a	2.12 a
NT-7	60.50 a	4.88 ab	4.92 b	50.33 ab	88.31 a	4.89 d	2.01 a
NT-8	60.73 a	5.62 a	6.34 ab	47.02 c	86.18 ab	6.23 b	1.84 a
NT-9	59.91 a	4.85a b	6.74 a	50.87 ab	87.17 ab	5.24 dc	1.61 a
NT-10	62.51 a	5.20 ab	5.28 ab	50.61 ab	87.96 a	4.85 d	1.86 a
Konkan Haritparni	62.85 a	5.04 ab	5.11 b	49.69 abc	86.66 ab	5.97 bc	1.71 a
C.D.	NS	NS	NS	NS	NS	0.857	NS
CV%	2.70	9.39	13.60	3.34	1.27	8.73	19.77

Table 2 : Lignin, Cellulose, Anthocyanin content, Oxaloacetate, Tannin, Phytate, Ash and ascorbate content in eleven Tannia genotypes leaves.

GENOYPES	Lignin %	Cellulose %	Anthocyanin quercetin equivalent/g	Oxaloacetate %	Tannin %	Phytate %	Ash %	Ascorbate
NT-1	4.23 e	19.57 a	abc22.13	0.25 b	16.45 de	1.91 abc	1.61 bcd	12.42 c
NT-2	5.39 d	20.02 a	a23.47	0.14 e	18.53 ab	1.80 bc	1.42 def	12.76 bc
NT-3	4.63 e	18.30 a	c20.30	0.07 g	19.18 a	1.70 bc	1.75 abc	13.82 abc
NT-4	4.51 e	18.97 a	c20.80	0.15 de	18.31 abc	2.02 abc	1.223 f	13.27 abc
NT-5	5.58 d	19.57 a	bc21.48	0.05 h	16.47 de	2.12 ab	1.85 ab	14.83 a
NT-6	5.76 d	19.907 a	bc21.59	0.326 a	18.61 ab	1.92 abc	1.3 ef	12.75 bc
NT-7	6.06 bc	19.73 a	a23.49	0.19 c	17.32bcde	1.48 c	1.98 a	14.46 ab
NT-8	6.14 bc	18.64 a	ab23.17	0.18 c	18.03abcd	1.63 bc	1.85 ab	13.54 abc
NT-9	7.08 a	18.87 a	a23.52	0.07 g	16.24 e	2.11 ab	1.78 abc	12.35 c
NT-10	6.42 b	19.07 a	a23.51	0.16 d	16.85 cde	1.82 bc	1.54 cde	12.51 c
Konkan Haritparni	5.55 d	19.29 a	a23.47	0.12 f	16.53 de	2.45 a	1.42 def	a15.02
C.D.	0.456	NS	1.638	0.022	1.493	NS	0.253	1.696
CV%	4.793	5.69	4.281	8.272	5.006	6.433	9.219	7.406

Table 3 : Micronutrient content (Fe, Mn, Zn and Cu) in eleven Tannia genotypes leaves.

GENOTYPES	Fe ppm	Mn ppm	Zn ppm	Cu ppm
NT-1	48.80 abcd	18.547 ab	13.197 ab	0.623 cd
NT-2	49.79 ab	17.747 ab	11.183 cd	0.817 ab
NT-3	47.36 cde	19.003 a	12.667 abc	0.543 e
NT-4	47.46 bcde	18.953 a	14.21 a	0.863 a
NT-5	45.63 e	18.16 ab	11.73 bcd	0.823 ab
NT-6	49.84 ab	17.997 ab	12.84 abc	0.57 de
NT-7	50.67 a	18.73 a	13.17 ab	0.527 e
NT-8	49.423abc	17.103 b	14.373 a	0.753 b
NT-9	46.97 de	18.183 ab	11.77 bcd	0.88 a
NT-10	49.113 abcd	18.99 a	10.68 d	0.667 c
Konkan Haritparni	48.21 bcd	17.64 ab	12.07 bcd	0.87 a
C.D.	2.135	NS	1.706	0.078
CV%	2.584	4.363	7.983	6.361